Manual

MWS 5MV-10 / MWS55MV

Microprocessor Weather Station

with datalogger (SD-card)

REINHARDT System- und Messelectronic GmbH

Bergstr. 33, D-86911 Dießen-Obermühlhausen

Tel. 0049 - (0) 8196/934100 Fax 0049 - (0)8196/7005 or 1414

E-Mail: wetter@reinhardt-testsystem.de

http://www.reinhardt-wetterstationen.de

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REINHARDT System- und Messelectronic GmbH
Bergstr. 33 86911 Diessen-Obermühlhausen Postfach 12 41 D-86908 Diessen Tel. 08196 - 934100

REINHARDT System- und Messelectronic GmbH
Fax: 08196/7005 and 1414 email: wetter@reinhardt-testsystem.de Web: http://www.reinhardt-wetterstationen.de

MWS 5M(V)-10 / MWS55M(V)

REINHARDT System- und Messelectronic GmbH
Fax: 08196/7005 and 1414 email: wetter@reinhardt-testsystem.de Web: http://www.reinhardt-wetterstationen.de

1 Caution

1.1 Intended Use

REINHARDT-Weather stations and sensors are exclusively built for stationary operation on a fixed 1" pipe for automatically collecting climatic parameters outside.

Any use other than described above may cause damage of the product or lead to other dangers.

Do not mount the weather station in reach of children and pets.

Carefully read the complete operating manual. It contains important information about the installation and operation.

If the MWS 5M(V)-10 /MWS 55M(V) is not used for a longer period of time you should store it lying to prevent escaping the lubricant from the ball bearings!

1.2 Safety Regulations

The instruments are manufactured according to modern technical standards and can be operated without danger when used as directed.

Damage caused by non-observance of this operating manual can lead to forfeiture of warranty. We shall not assume any liability for subsequent damage.

We shall not assume any liability for damage of items or persons caused by improper handling or non-observance of the safety instructions! In such cases any guarantee claims shall become null and void.

Dear customer, the following safety and hazard notices not only serve the protection of your health but also the protection of the appliance. Please read the following points carefully.

The supply voltage is converted by isolated transformers into voltages of maximum 24VDC. (The stations can be operated at voltages up to 28VDC).
Please do only use the supplied power supply units.

The weather station includes pointed and sharp-edged parts (i.e. windvane and edges of the sensor's housing), which may cause injuries when handled without care.

Do not leave the packaging material lying around. These parts are dangerous toys in the hands of children.

Handle the product with care. Blows or impact, or dropping it even from a small heigth will damage it.

1.3 Mounting

The weather station is mounted on a 1" water-pipe. This pipe must be fixed very well to stand high wind speeds above 150 km/h when the weather station is mounted.
The weather station is to be fixed well onto the 1" pipe with the screws. The stability of the weather station on the pipe must be established. Really check this after mounting the weather station!
Please mount the weather station on a place you easy can reach for maintenance purposes for the station can not be guaranteed to be absolutely maintenance free!!

You'll also find advice for mounting the weather station on your weatherCD.

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2 Setting Up the Weather Station

2.1 Installation of Hardware

MWS 5MV and MWS8 Weather Station has been designed for measuring the most important weather parameters temperature, humidity, barometric pressure, wind direction and wind speed. All parameters can be displayed graphically, digitally or as an "multiple display".
There is also a statistics and a history function.

Mount the weather station on a 1 " pipe. Orient the North-marker to North and clamp MWS 5M(V)-10 / MWS 55M(V) in place with the two pre-mounted high quality steel screws. Take care that the pipe is mounted as perpendicularly as possible, otherwise the windvane will not work properly and will preferably rotate in one direction.

N.B.

The wind vanes of the 5M(V)-10 / MWS 55M(V) weather station are very sensitive sensory equipment which can easily be destroyed by mechanical influence.
Therefore do keep the packing of your weather station. Whenever you want to ship your weather station later, this packing guarantees that the weather station is not damaged in transport !! Time and again we have noticed that the units are damaged by wrong packing. This is very annoying for the customer because he has to pay for all costs that may arise.
Please ask for a quotation of an original packing if it is no longer available to you (see last page).

The weather station must be set up at a place which is exposed to wind, because otherwise wind direction and wind speed cannot be measured correctly. (Please see "Directions of Deutscher Wetterdienst").

Connect the enclosed cable as follows:
Connect the 9pole connector to a free serial interface of your PC or to an USB port with a suitable COM to USB converter (with driver software which creates a virtual COM port).
Plug the power supply into a power outlet 100-240VAC / 50-60Hz.

Note on Security

Please note that you must in any case use the power supplies which we have provided with your MWS 5M(V)-10 / MWS 55M(V weather station or which are technically identical. Nominal value must be between 4 V and 28 V DC voltage; it must be possible to apply at least 100 mA (with optional heating element another 18 or 24VDC 1 A). Please note also that all the power supplies we provide are only made for use in dry rooms.
The 7 pole plug is connected to the Power / data socket of the weather station.
There are other sockets for additional sensors, for the power supply of a heating device and for an optional GPS-receiver. Power supply of the additional sensors can be provided by the weather station or by their own power supply. The output voltage of the additional sensors must not exceed +4.095 V, sensors with pulse output must be TTL-compatible.

IMPORTANT !

When removing any additional cables from the weather station, please don't forget to protect the socket with the cap and don't leave the socket open. Otherways the contacts of the socket will start corroding and be damaged within a short period of time!

Also don't forget to protect the plug of the cable from moisture by covering it when removing the weather station for calibration i.e. In this case also remove the wall adaptor of the power supply to ensure that no voltage is applied to the contacts of the weather station's plug when it is not used!

Otherways the plug will start corroding due to moisture and the cable has to be replaced within a short period of time.

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2.1.1 Overvoltage protection

The MWS 5M(V)-10 / MWS 55M(V) contains an integrated overvoltage protection (Suppressordiods) at it's supply- and data wires.

The power linie is protected by a SMCJ26CA-diode. This diode breaks through at voltages above 31VDC and is able to carry up to 1500W for a few milli seconds.

CAUTION: If you connect voltages above 30VDC permanently to the power jack, this diode will be destroyed within a few seconds!

The data lines are protected by SMBJ15CA-diodes able to carry transients up to 600W.

Also the housing made of high quality steel is connected to system ground.

This protection is suitable for protecting the station from damage due to overvoltage at close lightning strikes.

For protection of the connected peripherals (computer, camera, i.e.) the customer has to take further precautions (line protection, opto couplers, i.e.).

But please note that this protection is ineffective in case of direct lightning strike due to extremely high energy of lightning!

Currents of up to 200.000A can cause voltages up to 20.000V on the housing which leads to flashovers onto the internal electronic components and it's destruction.

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After installing the hardware you install the software.

2.2 Software Installation

Insert the WeatherCD into your CD-drive.
You need an HTML-capable browser (Netscape, Internet-Explorer or else).
If Autostart is activated, the CD starts on its own, if not, you execute STARTER.EXE in the CD root directory. Now you follow the instructions of the WeatherCD.

Note

The weather 32 software creates the HKEY_CURRENT_USER\Software\ReinhardtGmbH\Wetter\... key in the registry which is only created when running and is not deleted when the software is uninstalled.

After the software has been installed you connect the 7-pole plug to the POWER connector of the MWS 5M(V)-10 / MWS 55M(V). At the MWS 5MV you need to remove the lower 3 elements of the radiation shield by loosen the upper 3 pagoda screws to perform.

See also the mounting hints on the weather CD!

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2.3 Starting the Software

Start the software by double-clicking the program icon
After every start, the software checks the clock of MWS 5M(V)-10 / MWS 55M(V) and compares it to your computer clock. If it differs more than set in the file WEATHER32STATION.INI the software sets the MWS 5M(V)-10 / MWS 55M(V) clock automatically. Needless to say, the clock of the connected PC must give the correct time, as MWS 5M(V)-10 / MWS 55M(V) is set to the PC-clock. If your MWS 5M(V)-10 / MWS 55M(V) holds a GPS-receiver, it provides the correct time for MWS 5M(V)-10 / MWS 55M(V) (UTC time).

NOTE

In this case the weather station's clock CAN'T be set by the software! With the GPS receiver you start the software with the parameter -GPS (See sotware manual) for otherways there may be problems showing and storing data due to wrong time synchronisation!
Data recording to hard disk is started in the selected time interval (5 minutes by default). The software should run for at least one memory interval so that at least one data file is stored on the hard disk. This is important for reading out the datalogger later. (If there is no data file on the hard disk, the datalogger cannot be read out as the software does not find a start date.)

NOTE

MWS 5M(V)-10 / MWS 55M(V) only starts recording data to its datalogger after the time has been set. This guarantees that the datalogger holds only data with the correct time. The clock of the weather station is preset to CET when delivered. If your local time is different please ensure to set the correct timezone when using a GPS-receiver at the first start!
(See commands under 8.2 - Controlling the micro controller. (!ZZ)).
The MWS 5M(V)-10 / MWS 55M(V) has got an internal Lithium cell supplying the clock so that storing of data is performed immediately after connecting a the power supply without the need to set the clock before logging.

When using a GPS-receiver for setting the clock there may occur different problems, i.e. when the software tries to set the clock! (See FAQ on the weather CD)

If the software is not started, there might be a faulty data file on the hard disk or not enough free memory. This causes an abort.

The manual for the latest software you'll find here.

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3 Technical details

3.1 The data logger

The data logger of the MWS 5M(V)-10 / MWS 55M(V) has got an internal SD-Card with 4GB.
When storing data with an interval of 10 seconds the device stores 267840 data sets a month (31 days). With 10 active sensors (clock and date also counts as a sensor) the monthly data file has got a size of app. 21 MB.
So there are app. 250MB of data a year which allows storing of data for nearly 15 years without the need of deleting any data.
The data files are stored on the SD-card in the folder "/log/data".
Each month a new data file is being created which contains the month and the year in it's name.
The file suffix is "mws".
The name of the data file of march 2015 therefore is 03_2015.mws.
The data file are ASCII files (text files).
The SD-card contains other file important for operating the weather station. These files must not be deleted or edited.

3.2 In case of power failure

The datalogger of MWS 5M(V)-10 / MWS 55M(V) is kept up in case of power failure (EEPROMS), but no new data are stored.
In case of power failure, the clock of MWS 5M(V)-10 / MWS 55M(V) is kept running and doesn't need to be set when power is applied again!

Due to power failure there are data missing in the data files (time gaps). These gaps are filled with dummy values (-99999) by the weather32 software when reading the logger.
So missing data are indicated by measure values of -99999 in the datafile. The software then recognizes in the values of -99999 that data are missing and creates a gap in the graphical displays.

3.3 Maintenance

Because of its elaborated sensors, MWS 5M(V)-10 / MWS 55M(V) needs no maintenance.
There are wear parts like the ball bearings and the fan which have to be replaced from time to time.
These parts have got a life time of app. 5-6 years under normal environment conditions.
Extreme conditions (operation directly at the sea, high mountin regions, extreme pollution, i.e.) may cause very reduced life time of these parts.

MWS 5M(V)-10 / MWS 55M(V) weather station has been developed for stationary use under normal climatic conditions (temperate zone). Use under extreme conditions such as e.g. on board of a ship, mobile use on a measuring vehicle etc. has not been tested. It is therefore not recommended to set up the weather station where it is exposed to salt or salt water (e.g. right at the coast etc.).

It can be used on a measuring car under certain conditions although the measured values of the wind sensors cannot be reproduced.

Our warranty ends if there is any intervention into hardware or software from your side.

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3.4 The sensors

3.4.1 The Temperature Sensor

Temperature measurement is based on a precision precalibrated sensor SHT25 from Sensirion. The values are read internally via a I²C bus. The resulting measured value is additionally linearised by the weather station.
By standard, the temperature sensor is mounted on the lower side of the weather station. A white laquered pagoda protects against radiation and prevents a buildup of heat.
Range: from -40 °C to + 60 °C, measuring accuracy ± 0.3 °C, (display also possible in Kelvin or °Fahrenheit)
CAUTION: Compared to temperature measurements in big shielded cabins the measured values can be higher when the sun is shining. If the temperature measurements must correlate with the measurements in big shielded cabins you should measure temperature in the shaodow or measure with an additional temperature sensor placed in the shadow or in a big shielded cabin!
Unit: [°C]

3.4.2 The Humidity Sensor

is also based on a precision precalibrated sensor SHT25 from Sensirion. The values are read internally via a I²C bus. The resulting measured value is additionally linearised and compensated by the weather station. The sensor is also mounted on the lower side of the weather station. A Gore-Tex cover protects it from pollution or destruction by dust or insects.
The humidity sensor can be used in a temperature range between -40 °C to + 60 °C. It is linearized to an accuracy of 2 %.
Range: from 10 to 100 %, measuring accuracy ±2 %, display also as dewpoint measurement in °C or °F

NOTE

This sensor is very responsive to static charge and air pollution (dust, aggressive gases, but also salt). Please note that under unfavourable conditions (i.e. microbic stress caused by moulds, bacteria) this sensor ages faster than under normal conditions.
Unit: [%]

3.4.3 The Pressure Sensor

is a precalibrated digital sensor from Bosch (BMP085) which is read internally via a I²C bus. This sensor already is linearized to 4 hPa for the whole temperature range, the barometer is temperature compensated. Another temperature linearisation reduces the deviation to less than 2 hPa over the whole temperature range.
The sensor can be used in the temperature range of -40 °C to + 60 °C.
Measuring range: from 300 hPa to 1100 hPa with ± 0.8 hPa accuracy. Display can be reduced to 0 m above sea level (input of the local altitude in [m], display also in mm mercury column or Inch mercury column).
An additional output of barametric pressure (reduced to sea level) is possible. 3 different formulas are predefined within the weather station (simple formula, international barometric formula and barometric formula of DWD considering temperature and humidity).
Further formulas you may use within the weather32 software.

This sensor can be transported by air cargo!
Unit: [hPa]

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Bergstr. 33 86911 Diessen-Obermühlhausen Postfach 12 41 D-86908 Diessen Tel. 08196 - 934100

3.4.4 The Wind Speed Sensor

is made up of an anemometer with magnetic scanning. Wind speed is measured without touch using a Hall-sensor and a magnetic wheel with 12 magnets. A peak detector finds every wind peak and hands them on the measuring software. An average value is determined within the respective memory intervals.
Range: in km/h from 0 to 150 km/h with ± 2.5km/h measuring accuracy, (display also in m/s, miles/h, Knot or Beaufort), starting speed < 0.5 m/s.
As we have a very comfortable, 3-fold way of measuring wind speed with current wind speed (WG), average wind speed (WD) and wind peaks (WS), you can conform your wind measurement to your very needs.
Please note that dependent on the current winds, the 3 different methods of measuring wind speed can result in very differing graphs: When measuring WG, only a current value is written in the selected measuring interval, when measuring WD and WS, there is continuous evaluation and the whole measuring period is monitored.
Unit: [km/h]

3.4.5 The Wind Direction Sensor

There is a weather vane with a precision magnetical encoder and a rotation angle of 360 ° for measuring wind direction. Wind direction is given in °, with 90° being East, 180° being South, 270° being West and 0 ° being North.
Range: in 360 °, measuring accuracy 5 °, starting speed, < 0.6 m/s, hysteresis < 8°.

Output is performed as WR (current winddirection) and WV (main wind direction within a storage interval).

Unit: [°]

3.4.6 Rain / Precipitation Sensor (Option)

A self-emptying bucket is tilted by the collected rain. All the water that has been collected on the normed area of 200 cm^2 is led through a funnel to the bucket. The bucket tilts whenever a certain quantity of water has been collected. The tilting creates pulses which are counted. Out of the pulses, the software calculates the rain that has fallen per m^2. The current intensity of rain is also found and displayed. Unit: [mm] [l/m^2]
Range: from 0 to 5000 ltr/m^2,
Measuring accuracy ± 0.2 ltr/m^2

3.4.7 Light Intensity Sensor (Lux-Sensor) (Option)

measures light intensity in Lux. Measuring range is within the human eye response.
Range: from 0 to 220000 lx
Measuring resolution: 4 lux

3.4.8 Ultraviolet-radiationsensor (UV-Sensor) (Option)

measures ultraviolet radiation (UV-A) in mW/m^2. The spectral range is 320nm..395nm.
Range: 0 to 50000 mW/m^2
Measuring accuracy: +/-10%

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3.4.9 Additional Sensor

Any kind of sensors can be integrated as additional sensors. The information signal must be applied as voltage in the range between 0 V and + 4.095 V or it has to be adapted to MWS 5M(V)-10 / MWS 55M(V) by a special amplifier. Negative or higher voltages are blocked, but out of security reasons, should be avoided in any case!
The signals are linearized with up to 8 programmable inpterpolation value pairs by the MWS 5M(V)-10 / MWS 55M(V).
When can deliver a temperature sensor for measuring the soil or water temperature and a sensor for measuring the temperature of the road surface.

The MWS 5M(V)-10 / MWS 55M(V) can be equipped with an input for current signals (0..20mA). The signal of the current input is applied to pin6 and pin7 of the additional sensors socket. The sensors output has got the sensor identifier ZC in that case while sensor ZB can't be used in parallel to the current measurment!

Additional sensors can be voltage supplied by the weather station as long as their current consumption is below 25 mA.

NOTE

If current consumption exceeds this value, we cannot grant that MWS 5M weather station works properly !!!

If they need higher currents, the sensors must have an external power supply and its ground has to be connected to the MWS 5M(V)-10 / MWS 55M(V)-ground (Pin 1 of the 7-pole connector socket).

You can call for adjustment instructions of the additional inputs at any time.

3.4.10 Connecting an Additional Sensor

Additional sensors are connected to MWS 5M at the 8-pole socket.
The socket is allocated as follows:

Pin1 : GND
Pin2 : Input for precipitation sensor (TTL-pulse)
Pin3 : Input for analog additional sensor 4 (0..4.095V)
Pin4 : Input for analog additional sensor 5 (0..4.095V)
Pin5 : Input for analog additional sensor 1 (0..4.095V)
Pin6 : Input for analog additional sensor 2 (0..4.095V)
(option: I+ for current input 0..20mA)
Pin7 : Input for analog additional sensor 3 (0..4.095V)
(option: I- for current input 0..20mA)
Pin8 : Output operating voltage (9..20VDC) maximum 25mA

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3.5 Sensor Accuracy

Temperature:	± 0.3 °C
Humidity:	± 2.0 % (at 10°C..35°C)
Pressure:	± 0.8 hPa (at 0°C..50°C), ±2 hPa below 0°C
Rain/precipitation:	± 0.2 mm
Wind direction:	± 5° (at -10°C..50°C), hysteresis < 8°
Start speed:	< 0.5m/s (at -10°C..50°C)
Wind speed:	± 2.5 km/h (at -10°C..50°C)
Start speed:	< 0.6 m/s (at -10°C..50°C)
Global radiation:	+/- 50W (at 10°C..40°C)
UV-radiation:	+/- 10%
Light intensity:	+/- 6%
Additional sensor:	± 1 % of final value (at 0°C..50°C)

3.5.1 Measuring Ranges

Temperature:	from -40 ° to + 60 °, resolution 0.01 °
Relative humidity:f	rom 0 to 100 % resolution 0.01 %
Dewpoint:	from -40 ° to + 60 °, resolution 0.01 °
Barometric pressure:	from 950 hPa to 1050 hPa in 0.02 hPa resolution
Absolute pressure:	from 300 hPa to 1100hPa in 0.02 hPa resolution
Precipitation:	from 0 to 5000 mm with 0.1mm resolution
Wind direction:	0 to 360 °, resolution 0.02 °
Wind speed:	in km/h from 0 to 150 km/h with 0.05 km/h resolution
Global radiaion	from 0 to 1300 W/m² (Spectral range 0.3..2.8µm)
Light intensity:	from 0 to 220000 Lux (Spectral range: human eye response)
UV-radiation:	from 0 to 50000 mW/m² (Spectral range 320..395nm)
Additional inputs:	0- 4.095 V
Supply	4-28 V, 150 mA at 18 VDC, standard equipment

Dimensions

Size:	Outer diameter 90 mm, height 240 mm (MWS 5MV-10)
Weight:	app. 1.05 kg (MWS 5MV-10)
Weight:	app. 800 g (10m ready made cable with PSU)

The housing must be mounted centrally on a 1" pipe.
Standard cabling is 10 m - longer cabling on request.

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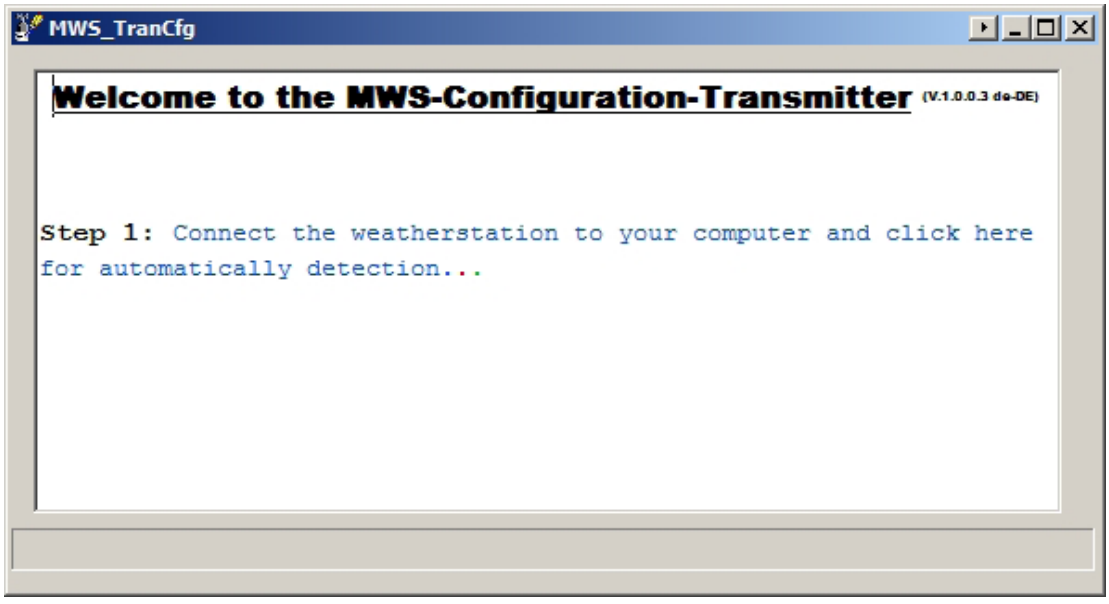
3.6 Adjustment of Additional Sensors

You will find the adjustment value pairs of your weather station in the MWS5M-10.XXX or MWS55M.XXX, with XXX a three-digit number.
These files are not in the scope of supply but you may get these files on request.
The additional sensor 1 ... 5 have got the identifiers ZA ... ZE.

By default the additional inputs are precalibrated in mV.
0mV cause an output of 0, 4095mV are a raw value of 65535.
Now you connect the additional sensor to the 8-pole socket.
Start a terminal program (e.g. Windows-terminal) and configure as follows: 9600 Baud, 8bit, no parity, 1 Stopbit.
You now change into the adjustment mode of the weather station with the command !W.
All sensors will be output with the internal measured raw values.
Here you can find out which raw value is created by your additional sensor at a respective analog value.
Example:
Expose a temperature sensor to 0°C aus, wait until the sensor has adapted to this temperature and then you see the respective raw value (i.e. 12500). You proceed with e.g. 30°C etc.
Note these pairs of values and replace the resprective lines in the adjustment file. It is most important that the first pair of values (e.g. !L5,1,F...) must contain the lowest voltage and the last pair of values must contain the highest voltage.
At least 2 pairs of values must be determined per sensor (e.g. !L5,1F,.... to L5,2,W..).
All pairs of values which are not needed must contain a raw value of 999999!!
After you have determined the necessary adjustment values and entered them in the adjustment file, you can transmit the changed file to the weather station as follows:
Start program MWS_TranCfg.exe and then chose the name of your adjustment file. The adjustment file contains many commands which are sent to the weather station.
Here you can see the steps of data transfer to your weather station with the tool MWS_Trancfg.exe. Transferring the data will need app. 5 minutes at 9600 baud.



Either click into the window for automatic detection of your weather station or selcet the COM port directly by right click as shown on the following pages:

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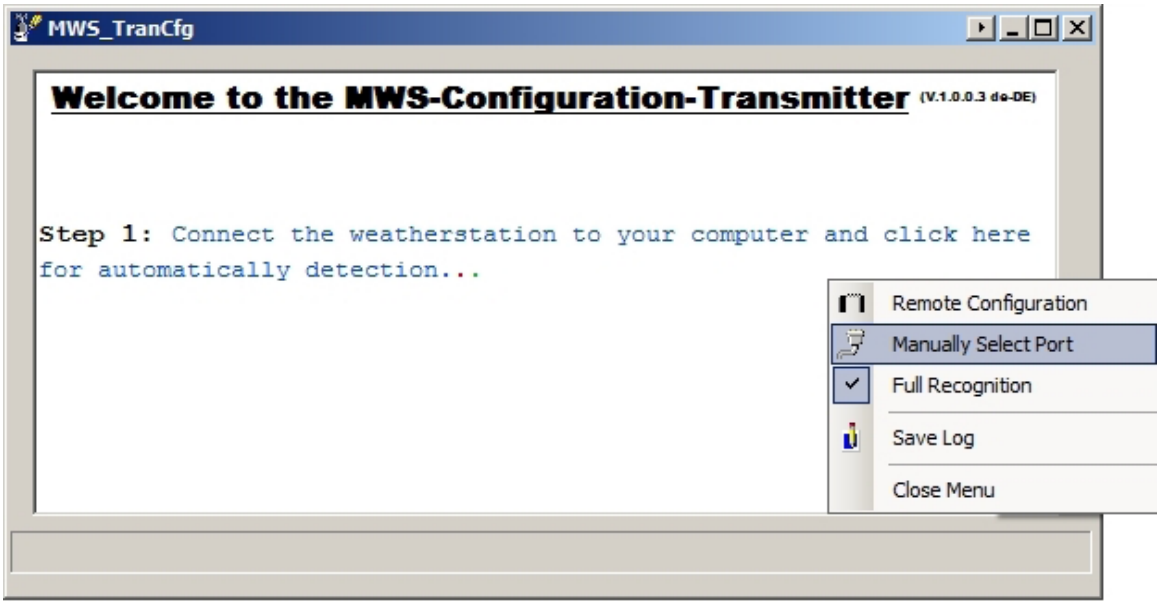

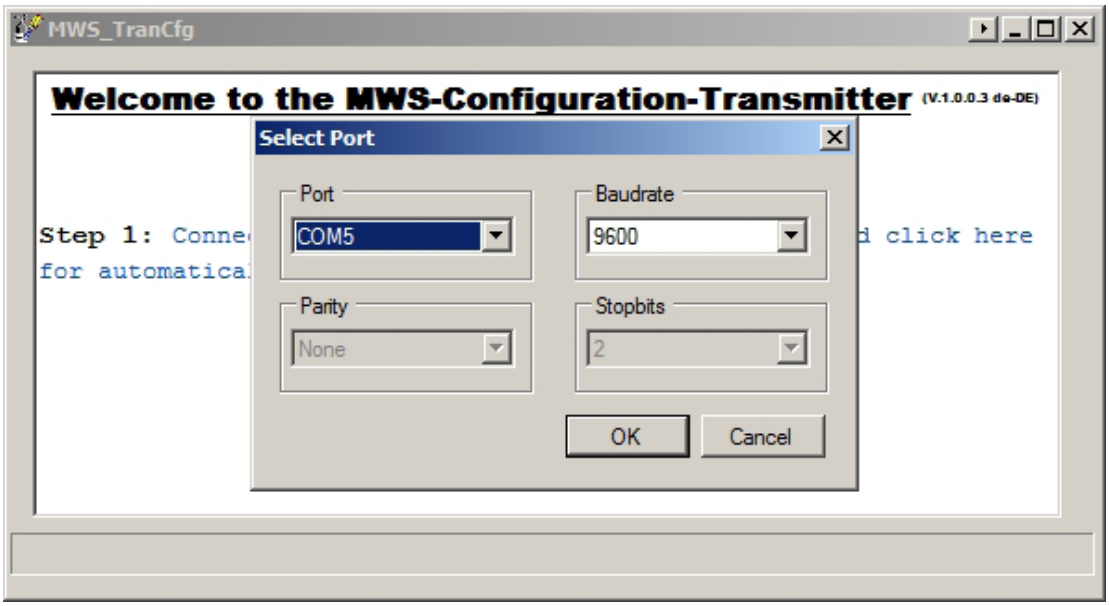

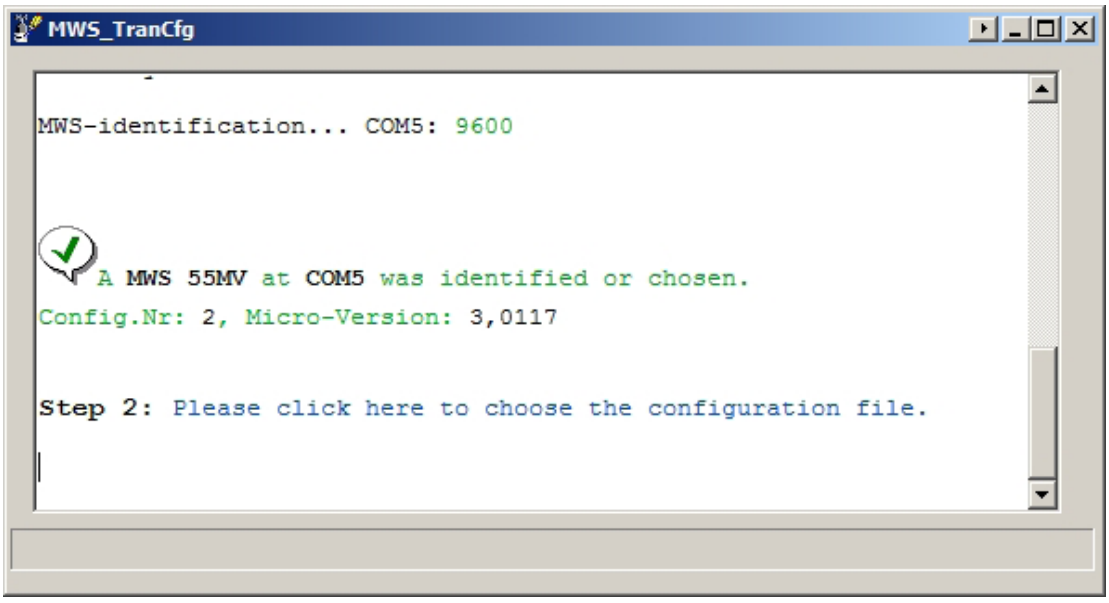

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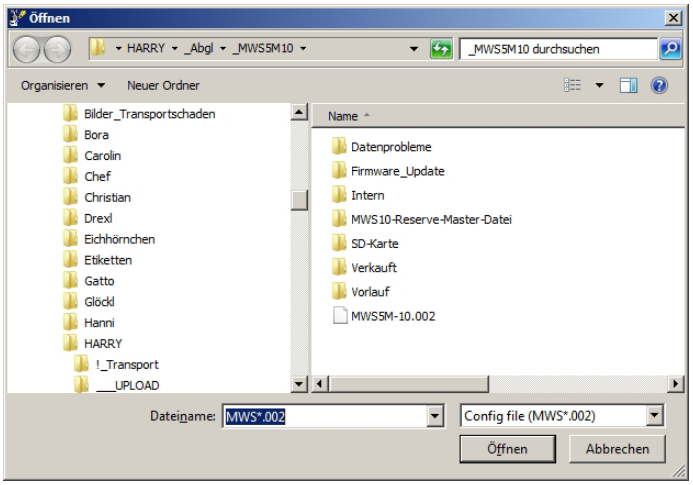
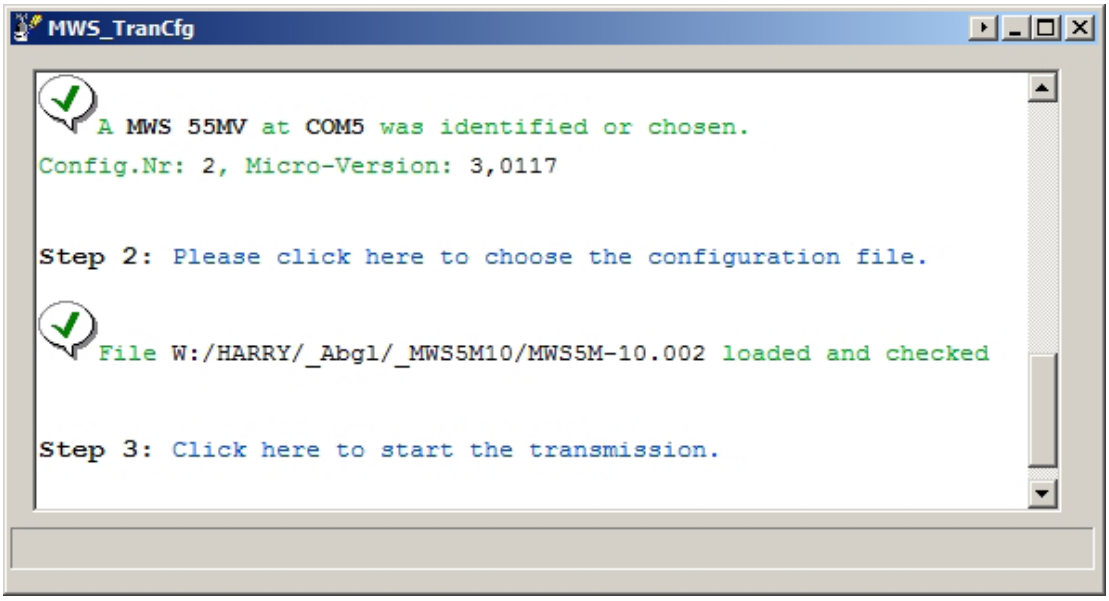
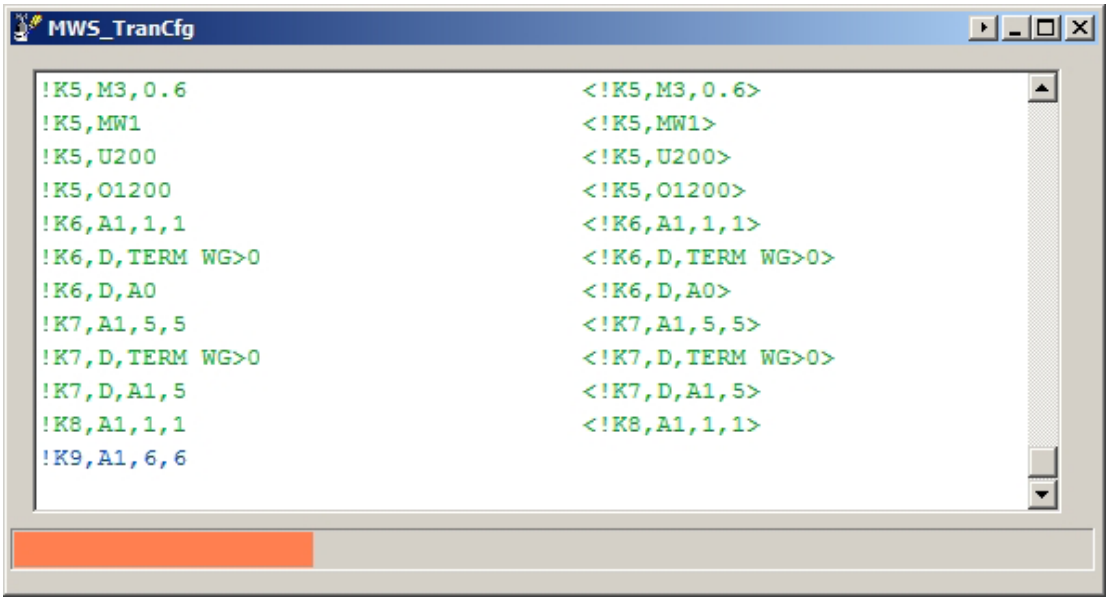


Chose the file for transfer to the weather station.

After chosing the file click into the window to start the transfer.

Sending the file to the weather station now is running. When errors occur the error codes will be highlighted in red text color.





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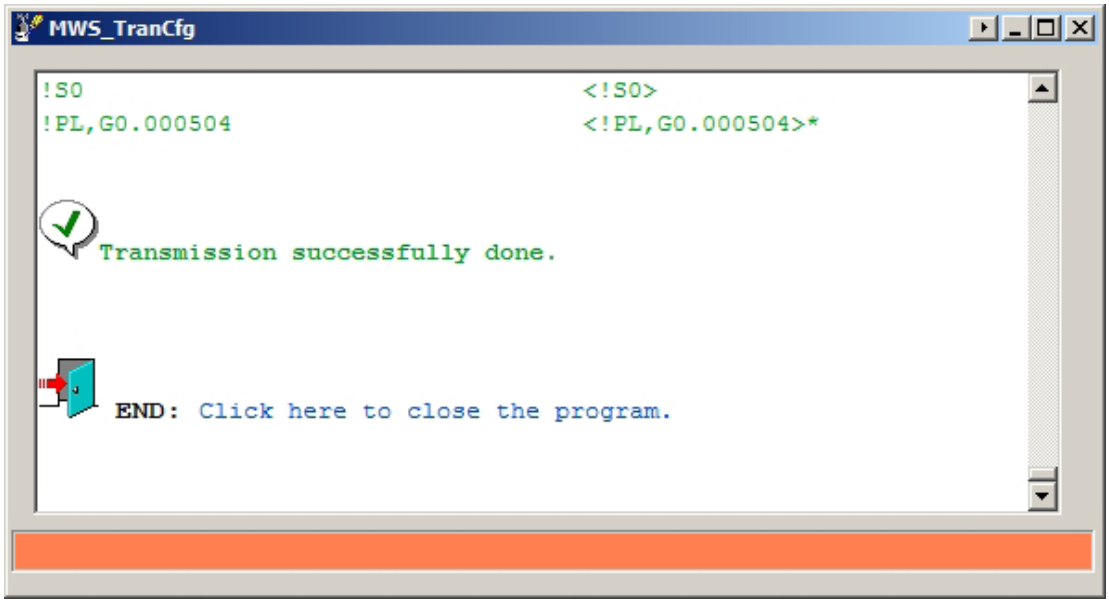

Do not in any case change the pairs of values of the other sensors as this would lead to wrong measurements of your weather station.

Example for a value calculation:
Additional temperature sensor at ZA with linear output of 10mV / °C, 0V at -40°C and a maximum value of +200°C.
The calibration value pairs for the first basic value are (raw value 0 and temperature -40°C):
!L5,1,F0 und !L5,1,W-40
The calibration value pairs for the second basic value must be in between the min and max values. (i.e. raw value 500mV and temperature +10°C):
!L5,2,F8002 und !L5,2,W10
The calibration value pairs for the last basic value are (raw value 2400mV and temperature +200°C):
!L5,3,F38409 und !L5,3,W200

Between these basic values the real measured values are calculated by simple rule of the three. I.e. if the raw value is 19500 you'll need the calibration value pairs 2 and 3.
Calculation:
(38409-8002)/(200-10) results in 160/°C.
Then (19500-8002)/160 leads to 71.9.
At last you add the value of basic value 2 to 71.9 (71.9 + 10).
The temperature at a raw value 19500 therefore is 81.9°C.

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3.7 Firmware Update

The MWS 5M(V)-10 / MWS 55M(V) allows updating the firmware via the serial port.

Start the tool "MWS_WUpda.exe" to perform.
(On the WeatherCD under SOFTWARE/MWS_WUpda)
In this folder also the current firmware version is stored.
Current firmware 25.03.2015: MWS_UPV3_0115.hex (Version 3.0115)

Updating the firmware is quite the same as transferring calibration files decribed above.

Updating the firmware takes app. 2 minutes at 115200 baud, app. 25 minutes at 9600 baud.

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3.8 Power Supply

4-28 VDC, app. 70mA at 18VDC. 18VDC PSU with 10m ready made cable is standard equipment.

When connecting any additional sensors, please note, that the supply voltage for the additional sensors is lead via a reverse polarity protection diode from the weather station's PSU.

Caution: Some additional sensors (LUX-sensor, Rain detector;..) need at least 9 VDC for proper operation!

3.8.1 Power consumption

Typical power consumption of MWS 5M(V)-10 / MWS 55M(V) with fan but without additional sensors at different voltages:

Current at 4VDC	: 370mA,	power consumption: 1.48W
Current at 5VDC	: 255mA,	power consumption: 1.28W
Current at 8VDC	: 145mA,	power consumption: 1.16W
Current at 10VDC	: 110mA,	power consumption: 1.10W
Current at 12VDC	: 100mA,	power consumption: 1.20W
Current at 15VDC	: 83mA,	power consumption: 1.25W
Current at 18VDC	: 70mA,	power consumption: 1.26W
Current at 24VDC	: 56mA,	power consumption: 1.34W

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3.9 Data Format

The data format of the transmitted data looks like this:
Example of a datastring :
15:24:32, 15.09.03, TE24.62, FE43.75, TD31.32, DR940.14, WR78.91, WV80.79, WG1.20, WS4.11, WD2.29, DB1013.32, TP11.47, WC24.62,
Each second MWS 5M(V)-10 / MWS 55M(V) transmits a data string starting with time and date. Separated by comma, the single measured values with sensor identification come in the following order:
Temperature (TE), humidity (FE), internal temperature (TD), absolute pressure (DR), wind direction (WR), prevailing wind direction (WV), wind speed (WG), wind peak (WS), average wind (WD), barometric pressure (DB), dewpoint (TP), windchill (WC).
You may change the order of the sensors by changing the positions of the sensors in the string (!Kxx). The commands to perform you'll find in the appendix.
By default, the data are transmitted with 9600BAUD, 8bit, no parity and a stopbit. (For evaluation with your own software, you can set several output modi - see appendix)

The datastring ends with <CR><LF>, each datastring which is written in the internal logger includes an additional ASCII #31 in front of <CR><LF> for data-synchronisation with the software.

Each data string which is read from the logger has got an ASCII #8 (TAB) in front of <CR><LF>.

On harddisk, a data file is created every month with a format which is similar to that of the transmitted data. The data files receive the extension .MWS
Example : The file of March 2015 is named 03_2015.MWS.

In case of missing data (cause by power fail, etc.) the software writes data with measuring values of -99999 to ensure integrity of the time axis. The software construes these values (-99999 and -99997) as missing data and creates measurement gaps in the graphical displays.

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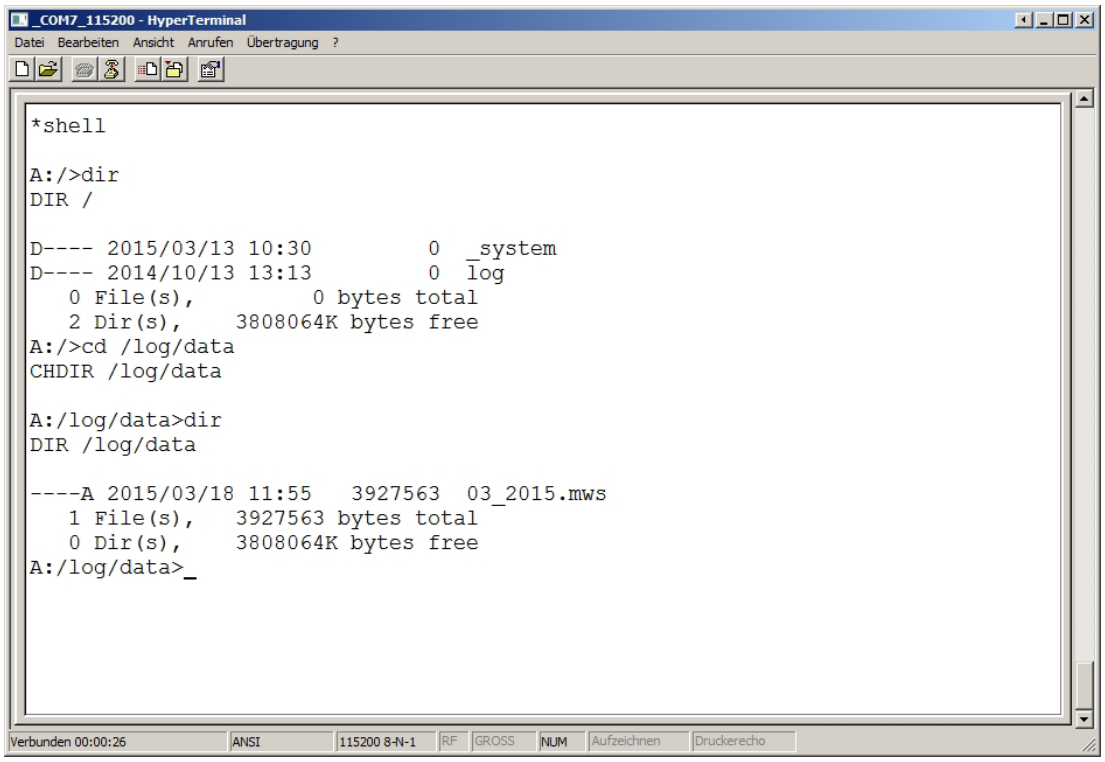
3.9.1 Data access onto the SD-card

The MWS 5M(V)-10 / MWS 55M(V) allows data access onto the SD-card with a shell similar to a DOS-window with different commands.

To perform send the command *shell in a terminal software like hyperterminal, putty or any other terminal program. The weather station then switches into the command window.

PLEASE NOTE THAT STATION DOES NOT STORE ANY DATA INTO THE LOGGER WHILE IT IS IN THE COMMAND WINDOW !



Pathes must be separated with slash (/) not with backslash (\).
To exit the shell please type EXIT and then press the ENTER key.

The shell can be used to delete weather data files which are not needed any longer, for storing calibration settings or for checking the free space on the SD-card.

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3.9.1.1 Available commands:

ATTRIB
CD / CHDIR
COPY
DEL
DIR
EXIT
FIND
FORMAT
FTIME
HELP
MD / MKDIR
MOUNT
REN
SHELL
TYPE
WRITE

3.9.1.2 Description of the commands

ATTRIB <+R|-R|+A|-A|+H|-H|+S|-S> <name>

Changes the attributs of a file or directory. The attributs must be typed in capital letters! The order doesn't matter.

+R -> Set to Read-Only
-R -> Remove Read-Only
+A -> Set to Archiv
-A -> Remove Archiv
+H -> Set to Hide
-H -> Remove Hide
+S -> Set to System
-S -> Remove System

CD <name> - Change path into directory
CHDIR <name> - Change path into directory

Changes into the specified sub directory

COPY <src_name> <dst_name>

Copies the file <src_name> to <dst_name>

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DEL <name>

Deletes the specified file or directory.
Caution! Deleting is performed without warning.

DIR [<path>]

Lists the content of the specified or current directory.

i.e.
D---- 2013/01/01 19:43 0 html
----A 2013/01/01 23:42 110 test.txt
Displayed: Attributes, file date, file time, file size (bytes), name.

Attribut D---- is a directory and has always got the size 0 bytes.

EXIT

Exits the Command-Shell.

FORMAT <logi drv#> <part type> <bytes/clust>

Formats the SD-card and creates a new file system (FAT).
CAUTION: Formatting is performed without warning!
<logi drv#> is the drive, <part type> is the patitioning rule(0:FDISK, 1:SFD)
<bytes/clust> are the allocation units.
i.e. formatting a memorz card> FORMAT A: 0 4096

FTIME HHMMSSDDMMYY <name>

Changes the file or directory time and date. The year is related to the year 2000.
i.e. FTIME 234200010113 test.txt
is output to:
----A 2013/01/01 23:42 110 test.txt

MOUNT <logi drv#>

Expicit mounting of a file system to drive <logi drv#>, i.e. MOUNT A:

MD <name>
MKDIR <name>

Creates a new sub directory.

REN <old_name> <new_name>

Renames the file or directory <old_name> to <new_name>

SHELL

(Re)starts the Command-Shell

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TYPE [<option>] <file_name/sector>

Shows the content of a file or sector.
<option>:
-s -> shows the specified sector in HEX format (512 Bytes)
i.e. TYPE -s 123456
-x -> shows the specified file in HEX format
z.B. TYPE -x test.txt
If used without <option> the file is shown in text format.
The output can be cancelled with ***!!!

WRITE [<option>] <file_name>

Creates the file <file_name> and receives characters via the serial port written into the file.

When receiving ***!!! the receiving of characters is cancelled and the file is being closed.

3.9.1.3 Saving settings onto the SD-card

***ADMIN SAVE CONFIG**

Saves all current settings into the text-file /_system/save/config.sav.
If there already is a config.sav file it will be saved under config.bak in the same directory.

3.9.1.4 Load settings from the SD-card

***ADMIN LOAD CONFIG**

Loads the file /_system/save/config.sav and integrates the contained settings into the FLASH memory.
This takes about 20 minutes. If the command was sent via the serial port, a progress bar is displayed:

LOAD CONFIG |---------+---------+---------+---------+---------I---------+---------+---------+---------+---------|

Each - stands for 1%, each + for 10% and the I for 50%.

CAUTION! If the FLASH memory is write protected (ADMIN LOCK), the command is performed but no data will be changed.
So this command only makes sense when the FLASH is not protected or when performed within the SECURE mode.

3.10 System requirements

At least a computer with Pentium1 / 200 Processor and 512MB RAM.
WIN ME, WIN2k, WIN XP, Vista, WINDOWS 7, WINDOWS 8.
VGA-graphic card with Monitor.

An online-help is available within the weather32 software with the F1 key or in the menue under '?'.

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4 Connections and Pin assignments

4.1 Cables

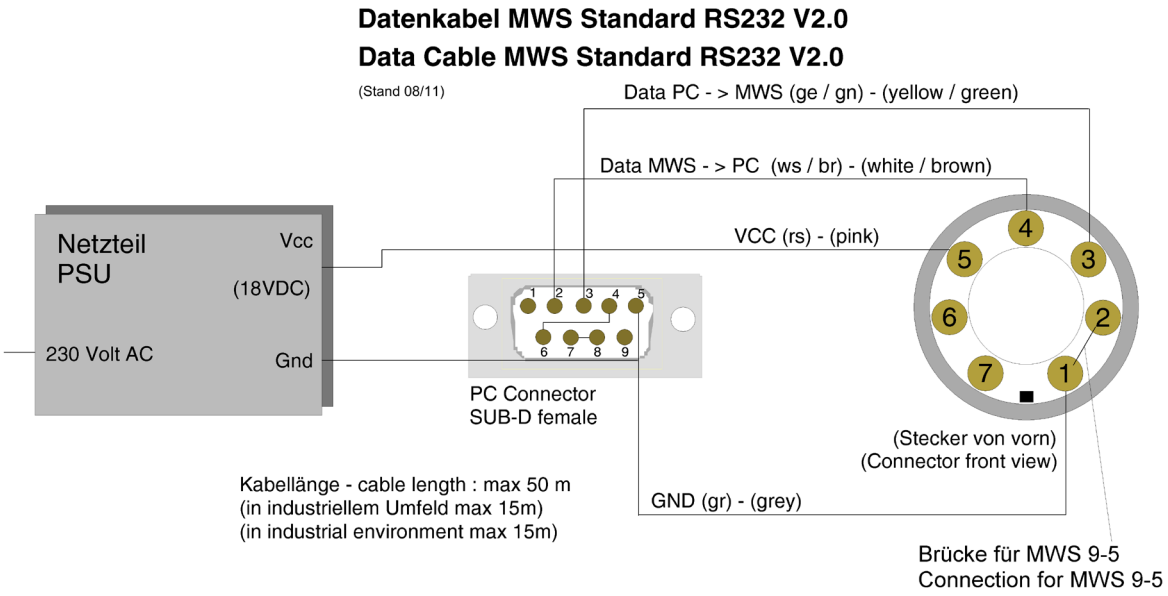
4.1.1 Data Cable - Allocation of the Connection Cable for 5M(V)-10 / MWS 55M(V)

7 pole connector (MWS - connection)		9-pole interface connector (computer)	
Pin 1	(GND) ⟷	Pin 5	(GND)
Pin 2	(GND - used for MWS 10)		
Pin 3	(RXD-MWS) ⟷	Pin 3	(TXD-PC)
Pin 4	(TXD-MWS) ⟷	Pin 2	(RXD-PC)
Pin 5	(VCC 18VDC)		
Pin 6	(R- with RS422 /485)		
Pin 7	(T- with RS422 /485)		
			Connect Pin 4 and 6
			Connect Pin 7 and 8

The data cable can be lengthened to up to 150 m at 9600baud under optimum conditions and with suited cable (not in industrial environment!!)
(see also 6.1.1. Allowed cable lengths)

In case you lengthen the data cable, please take care that the connections in the connector at the computer must be wired. (Connect Pin 4 to Pin6 and Pin7 to Pin8).

4.1.1.1 Connection Diagram Standard data cable



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4.1.2 Allocation of the Connection Cable for MWS Heating

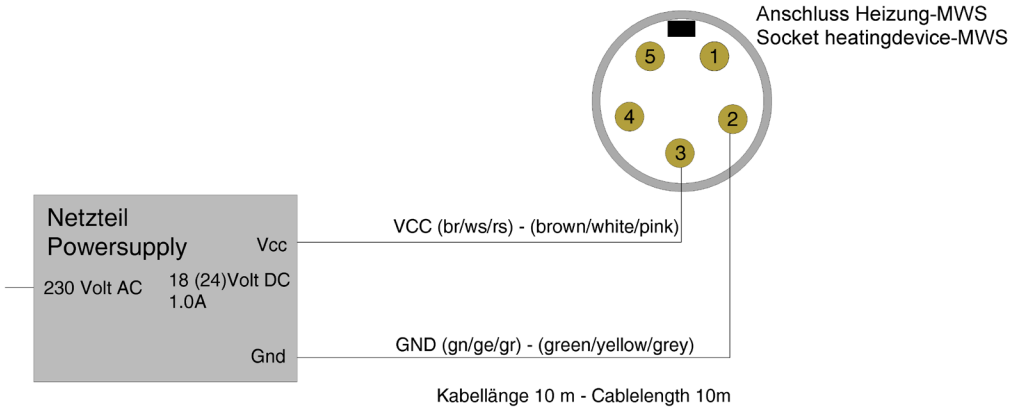
5 pole connector
(MWS 5MV-Heating and GPS-connection)

Pin	1	free		
Pin	2	(GND Heating)	⟷	GND-PSU 18VDC
Pin	3	(VCC Heating)	⟷	VCC-PSU 18VDC
Pin	4	free		
Pin	5	free		

4.1.2.1 Connection Diagram Cable for heating device

MWS Anschlusskabel für Heizung - Connectioncable for Heatingdevice

(alle Ansichten auf die Lötseite - all views onto solder side)



NOTE

The cable for the heating is 10 m long and can neither be lengthened nor shortened.
A GPS-receiver is connected to an MWS 5M with heating via the combined socket for GPS and heating with 2 separate cables and a special adaptor.

4.1.3 Allocation of the Connection Cable for GPS-Receiver (Garmin GPS 18x LVC) :

5 pole connector
(MWS 5MV-Heating and GPS-connection)

Pin	1	(GND GPS)	⟷	Garmin GPS 18x LVC GND
Pin	2	free		
Pin	3	free		
Pin	4	(Signal GPS)	⟷	Garmin GPS 18x LVC Out
Pin	5	(VCC GPS-5VDC)	⟷	Garmin GPS 18x LVC VCC

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4.1.4 Allocation of the Connection Cable for Heating and GPS-Receiver (Garmin GPS18x LVC):

5 pole connector
(MWS 5MV-Heating and GPS-connection)

1 x 5 pole connector		5-pole connector
Pin 2 (GND Heating)	<⟷>	GND-PSU 18VDC
Pin 3 (VCC Heating)	<⟷>	VCC-PSU 18VDC
Pin 1 (GND GPS)	<⟷>	Garmin GPS18x LVC GND
Pin 4 (Signal GPS)	<⟷>	Garmin GPS18x LVC Out
Pin 5 (VCC GPS-10..24VDC)	<⟷>	Garmin GPS18x LVC VCC

4.1.5 Allocation of the Connection Cable for Sensors with RS422-port

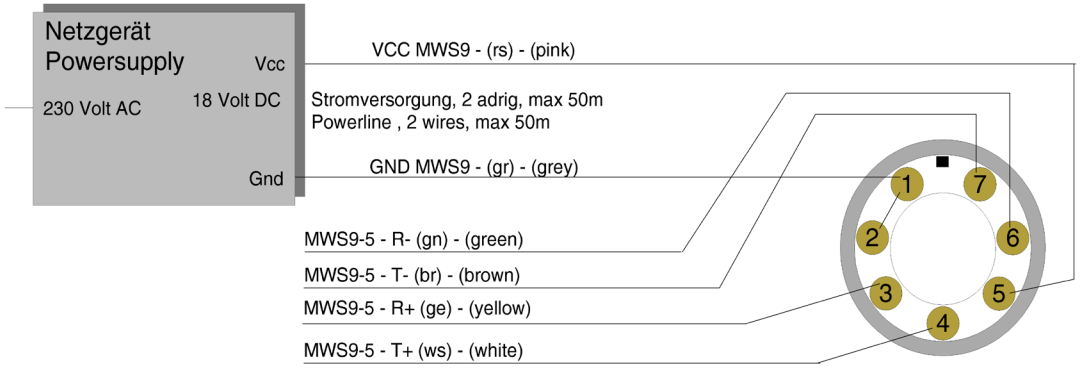
7 pole connector
(MWS 5M-power supply and data-connection)

Pin 1 (GND)	<⟷>	PSU-GND (grey)
Pin 2 (GND - used for MWS 10)		
Pin 3 (R+ of MWS)	<⟷>	wire (yellow)
Pin 4 (T+ of MWS)	<⟷>	wire (white)
Pin 5 (VCC 18VDC)	<⟷>	PSU-VCC (pink)
Pin 6 (R- of MWS)	<⟷>	wire (green)
Pin 7 (T- of MWS)	<⟷>	wire (brown)

MWS Datenkabel RS422 - MWS Datacable RS422

(Stand 08/11)

(alle Ansichten auf die Lötseite - all views onto solder side)



RS422 Datenkabel , 4 adrig, max 1000m
RS422 Datacable , 4 wires, max 1000m

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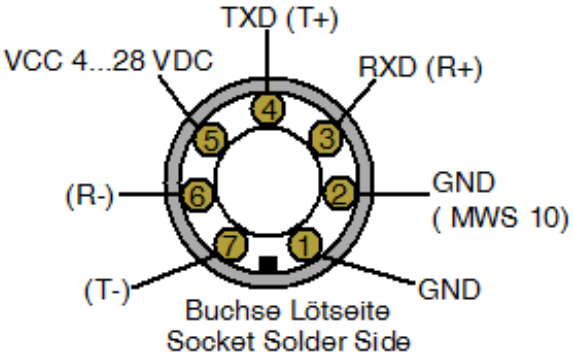
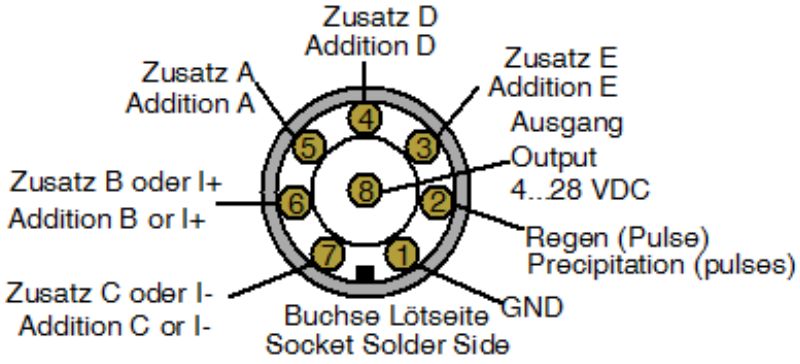
4.2 Pin assignments

4.2.1 Allocation of the MWS 5M(V)-10 / MWS 55M(V)-Connection Sockets

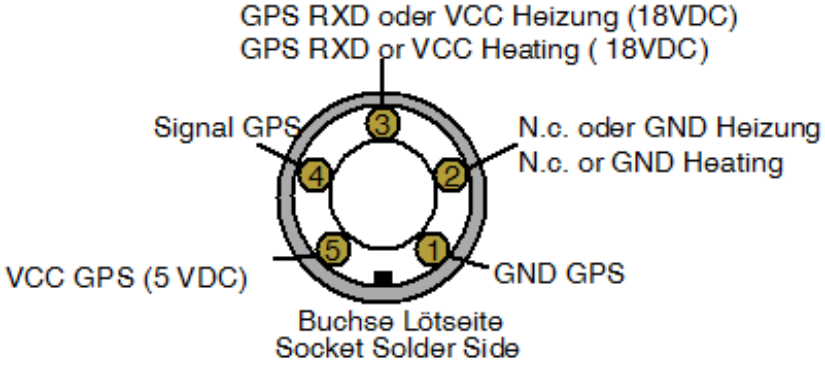
Buchse : Power und Daten
Socket : Power and Data



Buchse : Zusatzeingänge
Socket : Additional Inputs



Buchse GPS (GPS / Heizung)
Socket GPS (GPS / Heating)



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5 Excerpts from the Directions of DWD for Automatic Weather Stations

2.2 Regulations for Installation

2.2.1 Demands on Location
When you choose a place for the weather station, there must be no impediments, its horizon must be free. Soil and plants must be representative for its surroundings.
For measuring wind it is compulsory that there are no obstacles. Measuring the duration of sunshine especially is based on a free horizon.
When transmitting stations such as directional radio or installations for air traffic control are near, there must be additional shielding.
...
All preventive measures will prove useless if radio medium frequency transmitters are around.

2.2.2 Measuring field
The measuring field ought to be 10 x 10m, but at least 6 x 6m...

3. Sensors

3.1Measuring air temperature 200cm
By standard, air temperatur is measured 2m above ground...
In order to keep radiation errors as low as possible, air temperature ought to be measured in a weather hut...

3.4Measuring relative air humidity 200cm
By standard, relative air humidity is measured 2m above ground...

3.5Measuring precipitation 100cm
...
The collecting area is 200cm^2. The Hornersche Wippe (see-saw) tilts when it is filled with 2cm^2, i.e. 0.1 mm precipitation.

3.7Measuring windspeed
A cup anemometer is used for measuring wind speed. Its rotational speed is proportional to the horizontal wind speed.

3.8Measuring wind direction
A wind vane with a perpendicular rotary shaft is used for measuring wind direction. Its orientation in the wind results from the pressure difference on both sides of the vane.
By standard wind direction and wind speed is measured 10m above ground

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6 Trouble Shooting

6.1 Transfer problems

If the weather station is placed and mounted as described, there should be no problems in recording data.

When having problems with data transmission, you may decrease the Baud-rate or shorten the cable. You should use low capacitive cable when using cable length over 15m (RS232).

(Further hints on the weather CD under FAQs.)

6.1.1 Allowed cable lengths

Allowed cable lengths with standard cable at different baud rates are:
2.400Baud - up to 900 m, 4.800Baud - up to 300 m, 9.600Baud up to 152 m,
19.200Baud - up to 15 m, 57.600Baud - up to 5 m, 115.200Baud - <2 m.

Using the weatherstation in industrial environment can cause big problems in data transmission or even storing in the logger, when disturbance scatters into the cable. In this case you should use shielded cable or use RS422 Interface.

(Further hinter you'll find on the CD under FAQs)

6.2 No data / wrong baud rate

If you accidentally set the baud rate to a wrong value or the weather station does not respond to any commands you may try the follwing procedure to get access to the weather station again.

Start a terminal program with 9600baud, 8bit, no parity, no protocol.
Then you send exclamation marks (!) to the weather station coninuously. Power up the weather station. the follwoing messages should appear in the terminal window:
Secure-Immortal-Mode enabled
UART-Buffer...!!!!!!!!!!!!
Init Done

Then press the ENTER key once, the follwoing error message should appear:
<ERROR: !!!!!!!!!!!!!!!!!!!>

Then insert the command !B5 for setting to 9600baud and press the ENTER key.
The weather station then should send continuously:
SECURE
SECURE
SECURE
...

Then type the command !" and press the ENTER key to exit the SECURE mode.
The weather station now should send weather data each second.
Now it is is standard mode at 9600baud.

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6.3 RS422/RS485 interface

With RS422 data are sent immediately after applying power to the station.

With RS485 the station can receive data after applying power but does not send any data. The output is tri state. Data only will be sent on request with the correct address.
Initalization and memory check with RS485 are performed as well but without out of any data for the output is disabled (tri state).

While initializing after power up the weather station doesn't respond to any commands for app. 10 seconds.

For controlling the weather station with RS485 the address of the weather station must be added after the ! or ? command, otherways the unit won't respond to any command.

The default address with RS485 is 1.

The command for reading the current data set therefore is ?1U for example contrary to ?U with all the other interface versions.

6.4 Protocol-files (weather32 software)

6.4.1 Log-file in case of error (ErrLog.txt)

Softwareversions for sensors without logger same or newer than V2.26 writea log-file (**ErrLog.txt**) in case of errors (dataerrors or tranmission problems), in which the timepoint and kind of the error is stored. Older versions displayed an error-message like **!p** or **data error**, which was displayed permanently until the user clicked it away. This caused the problem that no further data were written for the time the message was visible although the error did not exist any longer.
In version same or newer V2.26 also an error message appears, but this message is deleted automatically when the error is removed. In this case an entry is written into the log-file.

6.4.2 Logfile when starting up (log.dat)

When the software for weatherstations and sensors with logger is started, the communications between the computer and the weatherstation is stored in a log-file (**log.dat**). With this file you may get important hints in case of problems.
Caution! This log-file is overwritten each time, when the software is restarted. To keep this file, store it in another place or rename it.
software.

6.4.3 Show output (internal)

In the software under *VIEW* and *SHOW OUTPUT* the software lists all communication with the weather station since the programm was started. Also the commands sent within the terminal window of the weather32 software will be listed.
This list you may copy into the clipboard to store it in a textfile for checking the communication in cases of problems.

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7 Options

More additional modules you can find here:
http://www.reinhardt-testsystem.de/english/climate_sensors/additional_modules.php

7.1 Available displays

7.1.1 Meteograph

Precision analog display with high grade stepping motors.
For indoor use only.

7.1.2 DKA1

LED mini display for alternating of up to 9 values. 13 mm digit size.
For indoor use only.

7.1.3 DMMK

Small digital meteo display for displaying 10 parameters simultaneously with digit size 13 mm.
Available for wall mounting or placing on a table.
For indoor use only.

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8 Technical Appendix

8.1 Control parameters for calibrating an additional sensor

PLEASE NOTE:
<#13> stands for ASCII-characater 13, (Carriage Return).
The command can also be closed with <#13><#10> (<CARRIAGE RETURN> - <LINE FEED>, i.e. <CR><LF>).

Changing from Measured Value output and Adjustment Mode (output of raw values):
!W<#13>

Transmitting the linearisation data:
!L<SENSORNUMMER>,<INDEX : 1..8>,F<ROHWERT><#13>

!L<SENSORNUMMER>,<INDEX : 1..8>,W<ANALOGWERT><#13>

E.g.: You measure 30540 V at 24.5 °C for additional sensor A in the 3rd position of your adjustment table, it will look like this :
!L5,3,F30540 <#13>
!L5,3,W24.5 <#13>

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8.2 Controlling the Microcontroller

8.2.1 Input parameters of MWS 5M(V)-10 / MWS 55M(V) -Microcontroller (Excerpt from the instruction set - The most important commands)

Reset:
!*<#13>

Setting the BAUD rate:
!B<X><#13> ; 0 < X < 9 : or baud rate directly 300..115200

BAUD-Rate for X =	0	:	300
	1	:	600
	2	:	1200
	3	:	2400
	4	:	4800
	5	:	9600 (default)
	6	:	19200
	7	:	38400
	8	:	57600
	9	:	115200

Hint:
After powering the station the baud rate is always set to 9600. So you may set the station to your desired baud rate if it has been changed by mistake. (see 6.2.)

Continue reading the logger after an interruption:
!C<#13>

Input flags for controls, !Fx, 0 <= x <= 255:
Bit 8 - Reserved (DEBUG_OUTPUT)
Bit 7 - Device-address (DA) with <CR><LF> in front of each data string
Bit 6 - Reserved
Bit 5 - Activates the GPS input for connecting another RS232 device.
By disabling this bit the interface and it's level shifter component is switched off.
Bit 4 - Reserved
Bit 3 - Reserved
Bit 2 - Reserved
Bit 1 - Immediate Store - Stores data when power is supplied even when the clock isn't set

!F+<Bit#><#13> ; Set single bit
!F-<Bit#><#13> ; Disable sinled bit
Example: !F-5 disables GPS-input

Switching on / off single sensors (List of all available sensor some pages later):
!KX,A0<#13> ; Sensor with output number X is disabled
!KX,A1<#13> ; Sensor with output number X is enabled

Attenuation for sensor X enable / disable:
!KX,A1,1,1<#13> ; Sensor with output number X is not averaged
!KX,A1,2,2<#13> ; Sensor with output number X is averaged
!KX,MW1<#13> ; Sensor with output number X is strongly averaged
!KX,M0<#13> ; Average off for sensor X

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Sending linearization data:
!L<SENSORNUMBER>,<INDEX : 1..8>,F<RAW VALUE)><#13>
!L<SENSORNUMBER>,<INDEX : 1..8>,W <ANALOG VALUE><#13>

Setting the altitude for calculating the barometric pressure:
!O<ALTITUDE(m)><#13>

Setting the factor for correct measurent of the supply voltage (VCC):
!PL,G0.000504

Reset of precipitation measurement:
!R<X><#13> X is the full hour for precipitation reset if storage interval is > 0 (logger on)
!R<#13> Sets precipitation to 0 if storage interval = 0 (logger off)

Controlling the interface (Protocol select)
CAUTION: THESE SETTINGS ARE VERY CRITICALLY!!

!S<DZ><#13> Suppresses inter alia the output of data
DZ is the decimal value from the following binary listfor the different protocols.

Binary list of protocol parameters for DZ.
DZ (binary) =

xxxxxx00b (bit 1+2)	:	RS232 - MWS sends a datastring each second
xxxxxx01b (bit 1+2)	:	RS422 - MWS sendet jede Sekunde einen Datensatz
xxxxxx10b (bit 1+2)	:	RS485 - MWS is addressed and sends data only on request
xxxxxx11b (bit 1+2)	:	Reserved
xxxxx1xxb (bit3)	:	MWS sends data only on request (RS232 + RS422)
xxxx1xxxb (bit4)	:	MWS sends data on request and when storing into the logger
xxxXxxxxb (bit5)	:	Reserved
xxXxxxxxb (bit6)	:	Reserved
x1xxxxxxb (bit7)	:	Sends check byte(bit 1+2≠11), simple XOR or CRC-8 (Bit21=1)
1xxxxxxxb (bit8)	:	Flash write protection

(Commands changing the data flash are rejected (except update))
This mode only can be cancelled in SECURE-Mode!

By adding of single binary values the paramweters can be combined.
Example for MWS with RS422 only sends on request:
for RS422 (binary) = xxxxxx01 (DZ=1)
for sending on request (binary) = xxxxx1xx (DZ=4)
added --> = xxxxx101 --> decimal = 5 --> !S5<#10>

CAUTION: With RS485 the weather station's address must always follow on ! or ?, for otherways the command won't be recognized! (Standard@ = 1)

!S+<Bit#><#13> ; Set single bit in protocol select
!S-<Bit#><#13> ; Set back single bit in protocol select
Example: !F+3 activates sending data on request and when storing.

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Set clock and date:
!U<TIME & DATE in format HHMMSSDDMMYY><#13>

Example: !U092030100515#13 sets the clockto 20 past 9 a.m. and 30 seconds on 10.05.2015.
When a GSM900 module is connected it's clock will be set, too!

!u<TIME & DATE in format HHMMSSDDMMYY><#13>

When a GSM900 module is connected the input of a small u only the clock of the weather station will be set. The clock of the GSM900 module won't be changed!

Changing between measurement output and calibration mode (raw value output):
!W<#13>

Set storage interval for data logger:
!Z<INTERVAL in 10 Seconds steps><#13>(0 = Logger off)
Valid values: 1..8640

!ZD<INTERVAL in 2 Seconds steps><#13> (0 = Logger off)
Valid values: 1..43200

!ZS<INTERVAL in 1 Seconds steps><#13> (0 = Logger off)
Valid values: 1..86400

Examples: !Z1#13 stores a data set each 10 seconds
!Z3#13 storage each 30 seconds
!ZD5#13 storage each 10 seconds
!ZD1#13 storage each 2 seconds
!Z12#13 storage each 2 minutes ...etc
!Z0#13 no storage

Time zone when receiving time by GPS (Deviation to UTC time):
!ZZx.x

Set time zone (UTC -> RTC). Settable in 15 minutes steps.
(with old MWS5M only in 1 hour steps). Valid values: -12 ... +13,
i.e. Venezuela: -4.5 (see: http://www.worldtimezone.com/)

!ZZA0|1

Automatic switching between day light savings time and winter time off / on.
When active on last Sunday in March the clock will be set to 03:00:00 after 01:59:59
and set to 02:00:00 after 02:59:59 on last Sunday in October.

!ZZDx

Number of hours being added or subtracted to DST or wintertime on automatic switching.
(standard = 1)

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8.2.2 SECURE-Mode

!"

Switches into SECURE mode which allows to change locked settings.
Output in Secure-Mode:
SECURE

8.2.3 Requesting the microcontroller

*** REQUESTS***

Get the current data string:
?U<#13>

Read stored data from a defined time & date:
?D<TIME & DATE in format HHMMSSDDMMYY><#13>

Read all stored data:
?D000000000000<#13>

Interrupt data output:
<#13>

Continue data output after interrupting:
!C<#13>

Cancelling data output:
<#13><#13>

Read all configuration data:
!?<#13>

!?0 <#13>
Output of main information.

!?1 <#13>
Output of information about the single sensors.

!?2 <#13>
Output of information about sensor #2 (temperature)

!?3 <#13>
Output of information about sensor #3 (humidity)

...etc.

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8.2.3 Meaning of the listing with !?0

DA: Device Address

DC: Device Capabilities !!! INTERNAL !!!

DI: Device Ident

DS: Device Serial

DV: Device Version

ME: Memory (capacity of SD-card in kByte)

MU: Memory Unused (free memory on SD-Karte in kByte)

MI: Memory Intervall (storage interval in seconds)

OD: Operation Days

A#: Calibration number

ER: Error
- Bit 8 = Reserved
- Bit 7 = ERR_EXT_MEMORY -> Memory card detected but not responding
- Bit 6 = Reserved
- Bit 5 = Reserved
- Bit 4 = Reserved
- Bit 3 = ERR_GPS_TIME -> No GPS time set in current hour until now
- Bit 2 = ERR_5V -> no 5V from USB
- Bit 1 = ERR_VIN -> Input voltage too low (leading **UNDERVOLTAGE**)

FL: Flags
- Bit 6..8 = Reserved
- Bit 5 = GPS_ONLINE GPS (or RS232-Sensors) ready (= Data string received)
- Bit 4 = GPS_CFG_MODEGPS-Configure mode active:
  Data at GPS-Input are mirrored to the PC-port
  (with leading *)
- Bit 3 = RAW_MODE
  Raw value mode active: Values are sent as raw values.
  (with leading **ABGLEICH** TKxxxx,)
- Bit 2 = SECURE_MODE
  No calculation and storing of any values, bypasses write protection
  Output of ** SECURE **
- Bit 1 = IMMORTAL_MODE
  COM port automatically (temporarily) set to RS232 with 9600 baud when received characters !!!!!!!!!!!! (RS232/9600)

PM: PageMode Reserved

PS: Protocol_Select (see !S)

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SC: SciFlags
Bit 8 = SCI_FRM_ERR -> Frame-Error (is deleted after request)
Bit 7 = SCI_OVR_ERR -> Overrun-Error (is deleted after request)
Bit 6 = SCI_PAR_ERR -> Parity-Error (is deleted after request)
Bit 5 = Reserved
Bit 4 = Reserved
Bit 3 = SCI_TX_ENA -> Sender active
Bit 2 = SCI_RX_ENA -> Receiver active
Bit 1 = TERMINATION -> Instruction termination (Carriage-Return) received

TZ: Time-Zone (UTCtoRTC), -12 ... +13,
(AUTO) shows that automatic DST switching is active,
(DST) shoes, that dazlight savings time is set
AT: Attenuation (not used)

HZ: Value for activation of heating device (not used)

TA: TK_calibration-Temp. (after I-Temp.raw value), 0-255

KM: Compressing value (not used)

IF: Admin-Flags (see !F)

PF: Power-Flags (undocumented)

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8.2.4 Order of the MWS 5M(V)-10 / MWS 55M(V) Sensors

Output #	*Sensor ID*	*Sensor*	*default*	*unit*
1	---	Clock / date	on	SS:MM:ss, TT.MM.JJ
2	TE	Temperature	on	[°C]
3	FE	Humidity	on	[%]
4	TD	Internal temperature	on	[°C]
5	DR	Absolute pressure	on	[hPa]
6	WR	Winddirection	on	[°]
7	WV	Main winddirection	on	[°]
8	WG	Wind speed	on	[km/h]
9	WS	Wind peak	on	[km/h]
10	WD	Wind average	on	[km/h]
11	RE	Precipitation	off	[mm] / [l/m²]
12	RD	Precipitation in storage interval	off	[mm] / [l/m²]
13	SO	Solar radiation	off	[W/m²]
14	ZA	Additional sensor 1	off	[mV]
15	ZB	Additional sensor 2	off	[mV]
16	ZC	Additional sensor 3	off	[mV]
17	ZD	Additional sensor 4	off	[mV]
18	ZE	Additional sensor 5	off	[mV]
19	ZF	Additional sensor 6	off	[mV]
20	UV	UV-Radiation	off	[mW/m²]
21	LX	Light intensity	off	[lux]
22	DB	Barometric pressure	on	[hPa]
23	TP	Dewpoint	on	[°C]
24	WC	Windchill	on	[°C]
25	---	not used	off	
26	---	not used	off	
27	OH	Altitude	off	[m]
28	GH	GPS-Altitude	off	[m]
29	GX	GPS-Latitude	off	
30	GY	GPS-Longitude	off	
31	GV	GPS-Speed	off	
32	GS	GPS-Satellites	off	

There are further reserved IDs for optional additional sensors:

RT : Rain detector
WU : Clouds base
WK : Clouds detector
WT : Temperature sensor of clouds sensor
FA : Fan speed
BA : Temperature Soil Sensor 140 at + 30cm
BB : Temperature Soil Sensor 140 at bei + 5cm
BC : Temperature Soil Sensor 140 at - 5cm
BD : Temperature Soil Sensor 140 at - 50cm
BE : Temperature Soil Sensor 140 at - 100cm

On the next pages you'll find a detailed description of all available (internal) sensors of the MWS 5M(V)-10 / MWS 55M(V):

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Sensor	Group	Sensor-Pos	Description	Sensoroptions	Sensor-ID	Datasource	Compensation	Special
0	I²C	(K2)	Temperature (SHT25) → TK Humidity (SHT25)		TE	L1 $96		
1	I²C	(K3)	Humidity (SHT25)		FE	L2 $97	Dependency Tab D1	
2	I²C	(K4)	Temperature (BMP180) → TK Pressure (BMP180)		TD	L3 $98		
3	I²C	(K5)	Pressure (BMP180)		DR	L4 $99	Dependency Tab D2	
4	I²C	K6 K7	Winddirection (AS5048B)	0: Clockwise 1: Counter clockwise	WR WV			
5	I²C		Magnitude (AS5048B)	1: AGC-Value (0..255)				
6	I²C	(K21)	LUX (TSL4531)		LX			
7	I²C							
8	I²C							
9	I²C							
10	I²C							
11	I²C							
12	I²C							
13	I²C							
14	I²C							
15	I²C							
16	I²C							
17	I²C							
18	I²C							
19	I²C							
20	I²C							
21	I²C							
22	I²C							
23	I²C							
24	I²C							
25	I²C							
26	I²C							
27	Ext_AD	(K16)	External AD-Converter, Channel 1		ZC	L7 $102		ZC Optional current input I- Channel n.c.
28	Ext_AD	(K15)	External AD-Converter, Channel 2		ZB	L6 $101		ZB Optional current input I+ → Ionut
29	Ext_AD	(K14)	External AD-Converter, Channel 3		ZA	L5 $100		
30	Ext_AD	(K17)	External AD-Converter, Channel 4		ZD	L8 $103		
31	Ext_AD	(K18)	External AD-Converter, Channel 5		ZE	L9 $104		
32	Ext_AD	(K13)	External AD-Converter, Channel 6		SO	L11 $106		
33	Ext_AD	(K19)	External AD-Converter, Channel 7		ZF	L10 $105		
34	Ext_AD	(K20)	External AD-Converter, Channel 8		UV	L12 $107		
35	GPS	K28	GPS-Altitude !G1		GH			
36	GPS	K29	GPS-X (Longitude) !G2	0: Original (° ' ") 1: Dezimal Grad	GX			
37	GPS	K30	GPS-Y (Latitude) !G3	0: Original (° ' ") 1: Dezimal Grad	GY			
38	GPS	K31	GPS-Speed !G4		GV			
39	GPS	K32	GPS-Sat (Current satellites) !G5		GS			
40	GPS		!G6					
41	RS232		RS232-Sensor 1 !G7					
42	RS232		RS232-Sensor 2 !G8					
43	RS232		RS232-Sensor 3 !G9					
44	RS232		RS232-Sensor 4 !G10					
45	RS232		RS232-Sensor 5 !G11					
46	RS232		RS232-Sensor 6 !G12					
47	RS232		RS232-Sensor 7 !G13					
48	RS232		RS232-Sensor 8 !G14					
49	RS232		RS232-Sensor 9 !G15					
50	RS232		RS232-Sensor 10 !G16					

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Sensor	Group	Sensor-Pos	Description	Sensoroptions	Sensor-ID	Datasource	Compensation	Special
51	RS232		RS232-Sensor 11 !G17					
52	RS232		RS232-Sensor 12 !G18					
53	RS232		RS232-Sensor 13 !G19					
54	RS232		RS232-Sensor 14 !G20					
55	RS232		RS232-Sensor 15 !G21					
56	RS232		RS232-Sensor 16 !G22					
57	Internal		Frequency lightning !I1	0: Counter (Raw val.) 1: Frequency (Hz) 2: Windspd. (1 x) 3: Windspd. (12 x) 10: Counter Resetval.				
58	Internal	K8 K9 K10	Frequency Windspeed !I2	0: Counter (Raw val.) 1: Frequency (Hz) 2: Windspd. (1 x 3: Windspd. (12 x) 10: Counter Resetval.	WG WS WD			
59	Internal	K11 K12	Frequency Precipitation !I3	0: Counter (Raw val.) 1: Frequency (Hz) 2: Windspd. (1 x) 3: Windspd. (12 x) 10: Counter Resetval.	RE RD			
60	Internal		Internal AD-Converter, Channel 1 (AD0_0) (*or Timer/Counter 4 !I4)	*0: Counter (Raw val.) *1: Frequency (Hz) *2: Windspd. (1 x) *3: Windspd. (12 x) *10: Counter Resetval.				
61	Internal		Internal AD-Converter, Channel 2 (AD0_1)					
62	Internal		Internal AD-Converter, Channel 3 (AD0_2)					
63	Internal		Internal AD-Converter, Channel 5 (VIN) !PL					
64	Virtual	K1	RTC (RealTimeClock: Time, Date)	P0: Date 2char P1: Date 2char US P4: Date 4char P5: Date 4char US				
65	Virtual		Time	0: 0 (Time) 1: Seconds 2: Minutes 3: Hours 4: Min. * 60 + Sec. 5: Hrs*3600+Min*60+Sec				
66	Virtual		Date	P0: Datum 2stellig P1: Datum 2stellig US P4: Datum 4stellig P5: Datum 4stellig US				
67	Virtual	K27	Altitude		OH			
68	Virtual							
69	Virtual							
70	Virtual							
71	Virtual							
72	Virtual		Output1 !V9					
73	Virtual		Output2 !V10					
74	Virtual		Output3 !V11					
75	Virtual		Output4 !V12					
76	Virtual		Output5 !V13					
77	Virtual		Output6 / Heating 1 !V14					
78	Virtual		Output7 / Heating 2 !V15					
79	Virtual		Output8 / Fan !V16					
80	Virtual	K22	Barometric Pressure !V17 S1 = TD, S2 = FE, S3 = Altitude, S4= DR	0: Intern.formula 1: DWD (+TE/FE) 2: BMP180 (simple)	DB			
81	Virtual	K23	Dewpoint !V18 S1 = TE, S2 = FE	0: Dewpoint W./Ice 1: Vap.Pressure W./Eis 2: Humidex 3: Heat Index	TP			
82	Virtual	K24	Windchill !V19 S1 = TE, S2 = WG	0: Formula 2001 1: Formula MWS5M	WC			
83	Virtual							
84	Virtual							
85	Virtual							
86	Virtual							
87	Virtual							
88	Virtual							

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Sensor	Group	Sensor-Pos	Description	Sensoroptions	Sensor-ID	Datasource	Compensation	Special
89	Virtual							
90	Virtual							
91	Virtual							
92	Virtual							
93	Virtual							
94	Virtual							
95	Virtual		!V32					
96	Linear	K2	Linear-Table 1 !L1			For TE		
97	Linear	K3	Linear-Table 2 !L2			For FE		
98	Linear	K4	Linear-Table 3 !L3			For TD		
99	Linear	K5	Linear-Table 4 !L4			For DR		
100	Linear	K14	Linear-Table 5 !L5			For ZA		
101	Linear	K15	Linear-Table 6 !L6			For ZB		
102	Linear	K16	Linear-Table 7 !L7			For ZC		
103	Linear	K17	Linear-Table 8 !L8			For ZD		
104	Linear	K18	Linear-Table 9 !L9			For ZE		
105	Linear	K19	Linear-Table 10 !L10			For ZF		
106	Linear	K13	Linear-Table 11 !L11			For SO		
107	Linear	K20	Linear-Table 12 !L12			For UV		
108	Linear		Linear-Table 13 !L13					
109	Linear		Linear-Table 14 !L14					
110	Linear		Linear-Table 15 !L15					
111	Linear		Linear-Table 16 !L16					
112	Linear		Linear-Table 17 !L17					
113	Linear		Linear-Table 18 !L18					
114	Linear		Linear-Table 19 !L19					
115	Linear		Linear-Table 20 !L20					
116	Linear		Linear-Table 21 !L21					
117	Linear		Linear-Table 22 !L22					
118	Linear		Linear-Table 23 !L23					
119	Linear		Linear-Table 24 !L24					
120	Linear		Linear-Table 25 !L25					
121	Linear		Linear-Table 26 !L26					
122	Linear		Linear-Table 27 !L27					
123	Linear		Linear-Table 28 !L28					
124	Linear		Linear-Table 29 !L29					
125	Linear		Linear-Table 30 !L30					
126	Linear		Linear-Table 31 !L31					
127	Linear		Linear-Table 32 !L32					

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This page is left free for further extensions!

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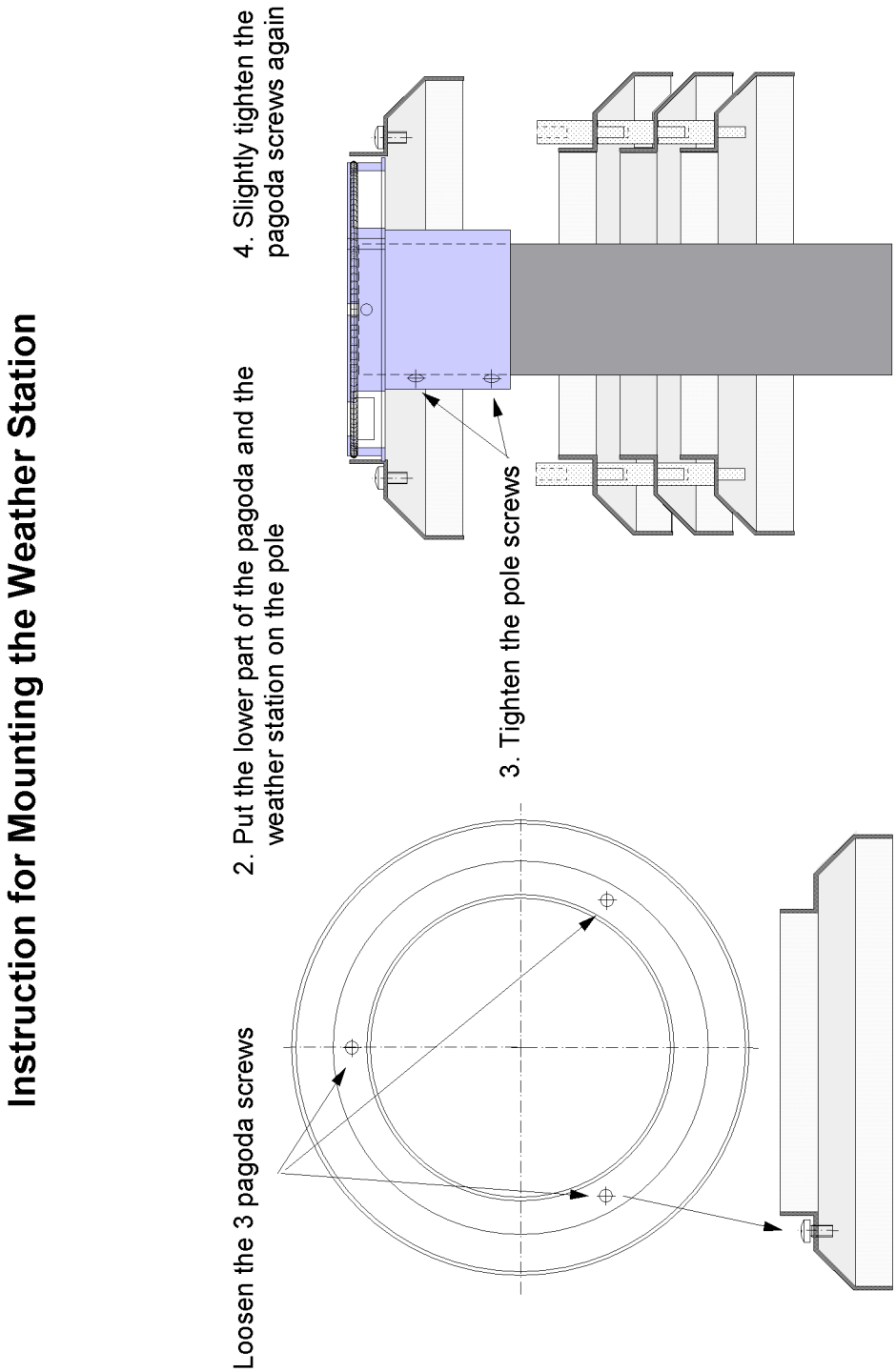
9 Instructions for Mounting the MWS5M(V)-10 / MWS 55M(V) Weather Station



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10 Packing MWS 5M(V)-10 / MWS 55M(V) properly

In case you want to ship your MWS 5M(V)-10 / MWS 55M(V), you must use the original packing. This packing was especially designed for MWS 5M(V)-10 / MWS 55M(V). It is the best protection against damage or destruction during transport. In this packing it will not even be damaged if it falls from 1 m height onto a stone floor.

Do not fill the packing with polystyrene flakes. They could damage the wind vanes when the package is closed as there might be high pressure.

11 Exchange Connectors

In case you have to replace connectors, please contact:
Fa. Adam, Tel: ++49 (0)8131 - 2808 51
The connectors belong to Series 711.
Below you will find the order numbers:

5way connector (heating / GPS) : **99-0095-102-05**
7way connector (data and power-supply) : **99-0475-102-07**
8way connector (additional sensors) : **99-0479-102-08**

Of course, you can order the connectors also from REINHARDT.